merely point out a few marked instances in justification of the criticism which we have felt compelled to make.

On page 19, the name "*Aretius*" is twice mentioned. There is no such author, and the translator has confused together *Aretæus* (the Cappadocian) and *Ætius*, who are severally quoted by M. Cullerier. *John of Gaddesden* was an *English* writer, and in a book in the English language should not be called "*Jean de Gaddesden*" [p. 40].—Astruc wrote in *Latin*, and it is a mistake to quote detached words of M. Cullerier's French translation, to give emphasis, as if quoting the original [pp. 40, 83]. —Burns (a Scotchman) did not write a "*Traité d'Accouchements*" [p. 53], but a work on the "*Principles of Midwifery*,"—There is no such word as "*pediculated*" in the English language [pp. 95, 181, 303]; and if there were, it would mean "afflicted with *pediculi*:" the English equivalent of the French "*pêdiculêes*" is *pedicellate.* The omission of a word on page 196 seriously alters the meaning of the text: the translation reads "a soft chancre is rarely found alone, and is *always* multiple;" M. Cullerier says "*presque toujours.*"

We might multiply instances, but the above are sufficient. On the other side, we must give the translator credit for correcting a misprint of the French edition, in a Latin quotation from Gerard [p. 20].

The work is called an *Atlas*, and its plates are therefore to be specially noticed. The 76 plates of the original are here accurately reproduced on 26 plates containing 145 figures. These we have very carefully examined, and have no hesitation in pronouncing them to be the best illustrations of any medical work in our language with which we are acquainted. To say that they are not quite equal to the originals, is merely to say that chromo-lithographs are not quite equal to fine steel engravings coloured by the hand of a finished artist. As chromo-lithographs they are superb, and compare very favourably with the celebrated illustrations of M. Ricord's "Clinique Iconographique." The only criticism which we have to make on this subject does not concern the plates themselves, but is that Plate XIV. Fig. 9, has no printed description.

We do not say that this is the best book on venereal diseases in the English language, for we do not consider it at all superior, if indeed it be equal, to Dr. Bumstead's own most excellent treatise. It is, however, the most splendidly illustrated work in the language, and in our opinion far more useful than its French original. It is besides furnished at little more than one-half the price of the French edition, and must, we think, remain for a long time the most desirable book on venereal diseases attainable by the American practitioner. J. A., JR.

ART. XX.—*Outlines of Physiology, Human and Comparative.* By JOHN MARSHALL, F. R. S., Professor of Surgery in University College, London; Surgeon to the University College Hospital. With additions by FRANCIS G. SMITH, M. D., Professor of Institutes of Medicine, in the University of Pennsylvania. Illustrated by numerous Wood-cuts. 8vo. pp. 1026. Philadelphia: Henry C. Lea, 1868.

THE author of this treatise is already favorably known to the profession as an excellent surgeon, and admirable clinical instructor. Endowed with mental qualifications, which have been liberally cultivated, he has not confined his studies to his more immediate specialty, but has been allured into the inviting field of physiological research—a field which offers to its cultivators, at the present day, probably as brilliant prospects of success as at any former epoch. With what industry and care the author has been labouring in this department of science the present work affords fair evidence. Though modestly claiming to be only the "Outlines of Physiology," a careful perusal of its contents will convince the student that the whole field has been thoroughly explored for treasures, new and old, and the entire domain of physiology, human and comparative, brought under closest scrutiny; so that no fact, experiment, or deduction of any importance, that has become known to the science of the present time, has been omitted.

In his preface, the author informs us that his work is designed with the special view to its utility as an *educational book;* and we must admit that he has fairly carried out his intention in the succeeding pages. Certainly, no higher claim to merit in a work, designed particularly for students, could be set up, than that it is truly *educational* in its character. This indeed involves a vast deal. It is to be presumed that all books designed for the student—certainly all text-books—are professedly educational; but it must be as certainly admitted that all do not come up to the true standard of this idea. How many works are constantly being sent forth from the press, which lack just this one essential qualification—their thorough adaptiveness *to educate* the student in this or that particular department of science? Such books may abound in facts and arguments of the greatest possible import; they may be perfect storehouses of knowledge and scientific research; they may be filled to repletion with the newest discoveries and experiments; and yet they may fail in the attainment of this great result.

Mr. Marshall's work is, we think, an exception to this class. He starts out with the idea of making everything as plain and simple as possible. He takes nothing for granted on the part of the student (a too common fault with authors of this class), except, of course, a proper elementary knowledge; but begins with laying a good substantial foundation for his physiological edifice, in a clear, familiar, and accurate, though compendious description of the human body in relation to its *anatomical* and *chemical* structure.

In an agreeable, concise style, he treats, first, of the General Plan of the Body, noticing, under this head, the bony skeleton, with its coverings of muscles, fasciæ, and integuments; its joints; its vessels and nerves; the great cavities of the body, cranial, thoracic, and abdominal, with their respective organs, all being sufficiently illustrated by appropriate diagrams, some of which are original. This is followed by a short practical working illustration, describing the mode of dissection of one of the inferior animals, such as a dog or a rabbit, which forms an excellent lesson for a beginner in physiological studies. Next in order, comes a general description of the Textures or Tissues of the Body, accompanied also with a practical illustration of the complex character of the organs, in a clearly described dissection of the tongue and larynx of a sheep. This is succeeded by a histological account of the tissues, copiously illustrated with familiar wood-cuts, and bringing the subject down to the latest authorities. As regards the nervous tissue, due atntteion is given to Prof. Beale's latest histological researches in relation to the origin and distribution of nerve-fibres. Under this head is found a sufficiently detailed account of the capillary system and of blood; also, of the epithelial surfaces (secreting membranes and glands); together with a table of the size of the different ultimate structural elements of the body.

After a very brief description of the Physical Properties of the Tissues, we have an accurate and clear *résumé* of the Chemical Composition of the Body; the proximate constituents being first considered separately, and afterwards the proximate chemical composition of the several tissues and fluids duly noticed, with a final reference to the ultimate chemical composition of the body.

Under the division of General Physiology, the author first discusses the Vital Properties of the Tissues. By the term *vital* here employed, we are to understand simply that these properties are manifested in *living* beings, or *during life.* Taken in this sense, and without any reference, at present, to the much-mooted question of the existence of a true vital force, the term is conveniently applied to describe certain properties peculiar to organized living beings, such as *contractility* (the muscular irritability of Haller), and *sensibility*—both of which are special, *i. e.*, confined to two distinctive tissues, the muscular and nervous, and which act only under proper stimuli; and likewise a third, or general property, common to all the living tissues, both animal and vegetable, and known as the *plastic force,* but named by the author appropriately, the *formative* or *organizing* property.

Perhaps no topic within the domain of physiological inquiry has given rise to a wider discussion than what has been named the *vital force.* All the earlier physiologists recognized the idea of a distinct separation between living matter and living force, just as the physicists of the past age considered that, either matter and force were completely separable, or else (at a later period), that while force was entirely separable from ponderable matter, it was closely united to an imponderable *ether,* or fluid. This is recognized as the doctrine of Descartes, Leibnitz, &c. Until within the last quarter of a century, the idea was all but universally prevalent, among physiologists, that all the functions of living beings were dependent upon a force, or power, quite distinct from the organs of the body, and altogether different from the ordinary forces which controlled inorganic bodies —such as the chemical, mechanical, dynamical, &c. To this unknown, recondite force, the term *vital* was applied, as serving a convenient purpose for disguising the ignorance of its real nature. In process of time, however, a closer investigation led to clearer views of the true character of the organic functions of the body. The researches of the chemist and microscopist unveiled the hidden mysteries of these processes, demonstrating conclusively that nearly all the living functions, both of animals and vegetables, are either simply chemical, or, more usually, chemico-mechanical. We need only instance the functions of digestion, respiration, and secretion, as proofs of this assertion. The beautiful doctrine of the Correlation of Forces, now so universally adopted, materially aided in bringing about this change of physiological views. But it also led—shall we say logically—a step farther. For when it was proven that heat, electricity, and magnetism were convertible forces, and that these again were transmutable into chemical force, and *vice versâ;* and finally, when Joule so happily demonstrated by experiment the perfect convertibility of heat into mechanic force, it did not require much stretch of the imagination to suppose that any, or all, of these great forces of nature might be correlative with, or convertible into, the true vital force.

But let us inquire where, in the whole range of life-actions, is this so-called *vital force* more especially manifested? Certainly (all will agree) not in the functions of digestion, absorption, circulation, secretion, or respiration. These, although confessedly life-actions (*i. e.*, living), are not *vital*, in the strictest sense of the term. But how is it when we examine into the function of Nutrition? By nutrition is understood, in brief, the conversion of the nutritive plasma, derived from the blood, into new structure, appropriated by each distinct tissue of the body "after its kind," molecule by molecule, according to its own peculiar type, just as it is required, in the room of particles constantly disintegrated in the wear and tear of these tissues. This is the essence of the function, although there are other accompaniments, such as the absorption of the residual plasma back again into the blood, together with the effete portions of the disintegrated tissues.

Our author so well describes this process of Nutrition further on in his book (pp..701–2), that we are sure it will afford a pleasure to the reader to let him speak for himself:—

"The second stage of the nutritive process consists in the exercise of a certain selective act, or so-called elective affinity, by the elementary parts of the tissues and organs, by which they assimilate to themselves such portions of the nutritive fluid as are suitable, either without, or with further change, to renew, molecule by molecule, their disintegrating substance. The nucleated cells of the epidermis and epithelium, the corpuscles of the gray matter of the brain, the tubular fibres of the white nervous tissues, the complex fibres of the striated muscles, the simple fibrous forms of the contractile fibres or fibre-cells of the organic muscular tissue, and of the fibrous and areolar tissues, and lastly, the consolidated intercellular substance, with the remnants of cells imbedded in it, as in cartilage and bone, each derives from the exuded plasma of the blood, and assimilates its required chemical constituents. The more rapid the waste the more active is the renovation, both processes being most marked in the muscular and nervous tissues, which produce and regulate all animal movement. This assimilative power of the tissue-elements is the persistent, primitive, nutritive force, inherited from the germ-cell. It is probably alike possessed by every cell, however remote in its descent from the parent-cell, and however modified so as to form parts of a composite animal or tissue, just as it undoubtedly is when a single cell constitutes the entire animal. This germ-force, or germinal force, is the essential cause of all nutritive phenomena, as it is of all organization, whether animal or vegetable. By it the cellular yeast-plant grows and maintains itself in fermenting saccharine solutions; the larger fungi feed themselves upon juices derived from decaying organic matter in the soil; the various tissues of the more complex flowering plants are formed and supported out of a common pabulum—the sap; and in the animal kingdom, the unicellular Gregarina, the sarcodous Rhizopod, the proteiform Amœba, the soft-bodied Culentærata, with their ectoderm, endoderm, and intermediate tissue; and lastly, all the complex and various organs of higher animals in the scale, and of Man are duly nourished. By this, the nerve-tissue attracts from the plasma outside the capillaries, its essential fatty and other constituents; the muscular fibre assumes the materials for fresh syntonyn; the cartilage, those for its chondrin; the bones, their peculiar animal and earthy materials; and so on of every other tissue of the body. The act of nutritive assimilation is said to imply a *metabolic* effect, operating in regard to the substance of the tissues; whilst, in development or evolution, this is associated with a *metamorphic*, which determines their form. Both kinds of nutritive phenomena are manifest chiefly, probably exclusively, in certain *areas* around the nuclei or corpuscles of the cells, the so-called *germinal centres*, which are therefore known as areas and centres of nutrition. The few cases in which, as in elastic ligaments, the nuclei or corpuscles are said to be absorbed, may only be apparent exceptions to the rule. Certain conditions of the blood and of the temperature of the body are essential to the occurrence of nutritive actions. They are most active at the commencement of the life of any animal, and gradually decline as that advances, until the power to maintain the body is overcome by the forces which lead to its degeneration and decay."

The author also here quotes from Prof. Graham's published views of Osmosis, especially with reference to his idea that "colloidal substances may not only be regarded as forming the essential plastic elements of the body," but also "that in the organizing and assimilating process, these collodial bodies do pass from the liquid into the pectose state, as they assume the form and characters of tissues and organs." Graham further considers that "the *energia*, or force peculiar to colloids, may be indeed the primary source of all the physical force appearing in the phenomena of vitality."

Assuming then, from what has been above stated, that it is in the function of nutrition, alone of all the organic functions, that the so-called *vital-force* is to be discovered, if anywhere in living beings, let us for a few moments examine the question, not forgetting that the essential part of this function is "the conversion of the plastic material into specific forms, which are endowed with specific functions." This, it will be admitted, is the highest possible attainment of all life-actions. It is inferior only to the sublime powers of the mind, acting out through the subtle avenues of thought and intellect.

To suppose that an amorphous albuminous substance, derived from the blood, has a power, *inherent* in itself, of being developed into the various forms of living tissue, will scarcely be maintained. Mere ordinary chemical affinities could never, out of this heterogeneous fluid, educe such a complex substance as brain, or muscle, or gland in animals, or as the alkaloidal compounds in plants. But may it not acquire this power by virtue of association with the ultimate cells, nuclei, or granules?

There are certain analogies in the inorganic world that would seem to sustain this idea. The well-known catalytic action of certain bodies—*e. g.*, platinum-sponge on a mixture of oxygen and hydrogen gases—is often adduced as an illustration; and such a catalytic, or, as it is termed, in this relation, *metabolic*, or rather *metamorphic* influence has been ascribed to the cell-wall, or to the nucleus of the cell. Admitting the analogy, or even the identity of action in the two cases, does not, unfortunately, give us a satisfactory *explanation* of either of them.

Dr. Bence Jones, in his late lectures at the Royal College of Physicians,[1] cogently argues against any special vital force apart from ordinary inorganic force, but ascribes it rather to a *mode of motion*, produced in the ultimate textures of the body, set in action by the chemical changes of the food and air received from without. After pointing out the fact that our ideas have been gradually undergoing a change regarding the connection between matter and force, in the physical sciences, he proceeds to reason in a similar mode for the biological sciences—those involving the idea of life. He sketches the change of views embraced by physiologists from the time of Hoffman, when several different vital fluids were supposed to pervade the animal body, each performing its own work. At a later day—we may say, in fact, in our own time—the prevalent doctrine has been, to use Dr. Pritchard's language, that this vital principle assumes the character of a plastic or formative force. "This doctrine ascribes to a thing, which is supposed to be merely a species of matter highly attenuated, properties and agencies which belong to the highest power, and the highest intelligence." The leading idea of "the inseparability and conservation of matter and force" is in Dr. Jones' hand, the master-key to unlock all the secrets of the formation of life. There are several selections from these lectures that we would gladly quote, as bearing upon this subject, were it not that a full *résumé* of them was given in this Journal, October, 1868, page 508, to which the reader is referred for details. Dr. Jones' idea is that, as inorganic matter and inorganic force always exist together in living beings, "if a separable living force be also present, then we must admit that two totally different laws of force must be in action at the same time, in the same matter;"—a thing which, to him, appears to be in opposition to the unity of nature. We are rather to search for vital force "as the most peculiar of all the motions of which matter is capable." But if we should inquire, What can be the nature of this motion? the reply must be, just what it always must be in reference to those phenomena in scientific investigations which are denominated *ultimate facts*—such as the essential causes of gravitation, heat, light, &c. Dr. Jones well observes, "If we are unable to grasp the marvellously complex double polar motion of compound molecules which constitutes electricity, can we expect to be able to form an idea of the most complex of all the motions of matter?"

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[1] Croonian Lectures on Matter and Force, by Henry Bence Jones, A. M., M. D., F. R. S. (British Med. Journal, Nos. 382-3-4-5, 1868.)

In concluding this rather lengthy digression, we may remark that Mr. Marshall evidently holds the opinion that there does exist in the living body a certain peculiar force distinct from all other forces, of whatever name and kind, and displaying itself by *a special formative* or *organizing energy*; this force he distinguishes by the term "vital."

> "The metabolic or assimilative process is evidently a chemical process of a higher character than ordinary chemical processes, or, as it may be termed, a *chemico-vital* process; but the metamorphic or plastic property is purely and absolutely a *vital* process." (p. 89.)
>
> "There exists, however, in the living animal, as in the living vegetable organism, a special *formative* or *organizing* energy evolving the perfect animal or plant from the primitive ovum or ovule, developing its various tissues and organs, and conserving these from the commencement to the termination of its individual existence. The influence of this force, moreover, extends from the parent to the offspring, generation after generation. Its relations to the vito-physical and vito-chemical forms of force, working in the body, are entirely unknown." (pp. 932–3.)

After all that has been said and written upon this subject, many persons will believe that it is a dispute rather about names than things; since even those, who oppose the doctrine of a *special* vital force, admit that some incomprehensible change is brought about in the ordinary forces of nature in *their transition into* this so-called vital force. For ourselves, we cannot help thinking that the argument is pushed too far, when the principle of life is reduced to nothing more than a mode of physical or chemical action, or a mere manifestation of motion, or of heat. Analogies may exist, which seem to level the barriers between them; but it seems to us that, notwithstanding all that has been hitherto alleged, the presumption is in favour of the opinion that life is something apart, and essentially different from all other kinds of force.

After taking a general view of the animal and vegetable functions, the author discusses, in a very interesting section, the Relations of Man with the Animal and Vegetable Kingdoms, under the first division of which he gives us a succinct outline of the animal kingdom, with a sufficiently definite description of the distinctive varieties of animal life, and pointing out the true position of man in the animal series. Under the second division, we have exhibited the relations of man and animals with plants, including the points of resemblance and of distinction between animals and vegetables.

The division of Special Physiology comprises, of course, the great bulk of the volume. Under this general head we have treated, in sufficient detail, and in their appropriate sections, all the various functions and phenomena of the human body, commencing with those of animal life, and followed by those of vegetative life; the whole terminating with a consideration of the function of Reproduction, to which is appended a brief account of the growth of the body, its decay and death. Throughout this portion of his work the author has introduced what strikes us as a very happy and original arrangement by which the essential character of each of the great functions of man are impressed upon the student by a close and accurate comparison instituted with these same functions, as exhibited in the different classes of animals. At the end of each section, describing any particular function, to use the author's own language in the preface, "the general and essential characters of a function, as distinguished from its special characters in man, are illustrated by copious references to the structure and uses of the organs concerned in that function in the several classes of animals." It is certainly only by such a careful comparison, that we can arrive at a satisfactory result as to the true character of the bodily functions.

To examine critically each one of the foregoing sections would consume much more space than can be allotted to this paper; neither is it necessary, since so much has been already written, and ably written, upon the subject. We may, however, claim the privilege of making a few passing observations, here and there, in connection with some special subject, such as may be thereby suggested.

Under the general title of Motion, the author discusses the various kinds of movements in animals and vegetables. Four of these he classifies under the title of *vital*, viz., the muscular, ciliary, sarcodous, or such as occur in contractile sarcodous cells and protoplasmic; drawing a distinctive line between these and the purely physical, or physico-vital—such as the movements due to elasticity, osmosis, and certain recondite molecular movements.

The main point of interest connected with this topic is, What is the nature and cause of the movements in living beings? We may make these inquiries, first, in reference to muscular contractility. Mr. Marshall, after a pretty close examination of the case, adopts the conclusion most generally received, that the cause of muscular contractility is intrinsic, and is due to a *vis musculosa*, or *vis insita*, which is, in effect, the old Hallerian doctrine of irritability. But that this is not perfectly satisfactory to himself, is evident from the fact that he feels perplexed—as do all—about the *ultimate cause* of the attraction and repulsion between the sarcous elements. Without allusion to the chemical theory of Liebig and others, he suggests, what has become a somewhat fashionable theory of late years, the polar or electrical doctrine, which involves the ingenious idea of an opposite polar arrangement, or a condition subsisting among the ultimate elements, by virtue of which the phenomena of attraction and repulsion would ensue. This idea receives a certain support from the known fact of the development of both heat and electrical currents during muscular contraction. Allusion is also made to Prof. Graham's suggestive idea "that osmotic changes in the contents of the tubular sarcolemma of the muscular fibre, may possibly occur as essential conditions of its alternate contraction and relaxation."

Dr. Bence Jones, to whose recent discourses we have already referred, is of the opinion that muscular contractility, like all the other so-called vital actions, is only a *mode of motion* (to use Prof. Tyndal's expression), brought about by some antecedent equivalent motion. Referring to the earliest ideas of muscular motion as being connected with the soul, he next alludes to the succeeding doctrine of an innate power, capable of responding to external stimuli. Of this idea, Haller's doctrine of irritability is cited as the best exponent; but, according to the latest theory, its origin must be some antecedent equivalent motion. Professors Liebig, Playfair, and others, are of the opinion that the chemical changes in the nitrogenous matter of the muscles are the cause of motion. But, according to Frankland, Fick, and others, the amount of mechanical work performed is much greater than can be accounted for by the amount of change in this matter, as measured by the quantity of urea produced. Taking this as the true index, it would appear that four-fifths of the work must arise from the chemical action going on in the non-nitrogenized matters in the muscles, or in the surrounding blood.

These deductions seem, moreover, to be borne out by Dr. Parkes' experiments, by which it is shown that the motion of the muscle during exercise bears no relationship to the amount of chemical disintegration of the albuminous materials. He is, therefore, inclined to the opinion that "the action of the muscle is not connected with disintegration, but with formation;" and that, consequently, "it more rapidly disintegrates during rest than during exercise."

The real cause of ciliary movement is still a *questio vexata*. Mr. Marshall, after telling us all that is known upon the subject, feels constrained to acknowledge that "the true explanation of the phenomena of ciliary motion has yet to be discovered."

The peculiar movements of living spermatozoa in the seminal fluid, though not distinctly alluded to by the author, are evidently classed by him among "the movements of animal sarcodous and protaplasms."

The section allotted to Animal Motion includes also Locomotion of Man and Animals on solids, in fluids and in air; Animal Mechanics, Prehension and Manipulation, Expression and Gesture, Voice and Speech. These subjects require no further notice, at present, than merely to say that they are treated of in a very agreeable and instructive manner.

Under the head of Sensibility, our author discusses very freely the subject of the nature and phenomena of the *nerve-force*. Some interesting experiments of Helmholtz in relation to the rate of conductibility in the motor and sensory nerves, both of man and the lower animals, are detailed. By a curiously contrived apparatus, the exact period of time required for a galvanic stimulus to pass through a particular nerve is registered; by which it appears that

> "In the motor nerves of the frog, at a temperature between 52° and 70°, the rate of conduction was found to vary from 81 to 126 feet per second. In warm-blooded animals and in man, it has been estimated to be rather more than 200 feet per second. The rate of motion of an electrical current, travelling along a metallic wire, has been shown to be 462,000,000 feet per second. Light

travels about 40,000 miles in the same period. The rate of conduction of impressions in sensory nerves has been calculated, by Hirsch, to be about 110 feet per second. The same observer states that the rate of propagation differs in regard to the nerves of touch, hearing, and sight; but the numerical results obtained by him are variable. Some difference, however, may exist in different nerves, for contraction of the iris, in rabbits, occurs quickly on irritation of the third cranial nerve, but more slowly after irritation of the fifth (Budge). The rate of propagation is moreover influenced by the strength of the stimulus. * * * " (pp. 223-4.)

The difference between the *electronic* condition of nerves and muscles is very satisfactorily illustrated by several diagrams, and the results of carefully conducted experiments are properly noticed.

As regards the true nature of nerve-force, the author, after rejecting the ideas, either "of a *special* force, proper to living nerve-substance—a *vital force* wholly different, even in kind, from any other force in nature," or of electricity, evidently inclines to the third view that has been proposed, viz., "a special form of the common force of nature, correlated to electricity, and through it to all the other forms of that force." (pp. 232-3.) After giving substantial reasons against considering nerve-force to be identical with ordinary electricity, he proceeds to say (p. 234):—

"Now, it is not supposed that the force acting in a nerve is identical with electrical force, nor yet a peculiar kind of electricity, nor even physically induced by it, as magnetism may be; but, that in the special action of a living nerve, a force is generated peculiar to that tissue, which is so correlated with electricity, that an equivalent of the one may, in some yet unknown manner, excite, give rise to, or even be converted into, the other. In this concatenation of the several forces of nature, physical and vital, the force acting in a nerve may also be correlated with chemical force, with the heat developed in the muscle, and even with the peculiar molecular motions which produce muscular contraction, and all its accompanying physical or mechanical consequences. Indeed, as it is more acceptable to the human mind to suppose that the quantity of force, like the quantity of matter in the existing order of nature, remains the same, and is never lost or annihilated, from such notion of the interchange of inorganic into organic, and of organic into inorganic force, must be entertained. On this view, the nerve-force is as it were nourished from physical force, as the living substance of the nervous tissue is fed from the inorganic materials of the dead world."

As respects *sensation and consciousness*, together with all the higher mental faculties, no attempt is made to explain their mode of action by reference to any sort of mere physical force, however sublimated. The author is evidently no materialist; but, acknowledging "the mystery" of the subject, he bows with a becoming reverence before the Divinity imaged in the soul of man.

The Cerebro-spinal and the Sympathetic Nervous System are sufficiently well described, both as regards their anatomy and functions. Nothing of importance concerning this interesting department seems to be omitted. Under the head of Sleep, a very brief allusion is made to the subject of *mesmerism* and *clairvoyance*. The latter is classed among the delusions of "spirit-rappers." These are confessedly difficult topics to handle, and the author evidently has little relish for them. The deep mysteries of some of the psychological operations may, possibly, continue to remain unexplained in our present condition of existence; but we presume that no reflecting person, who has given the subject any study, will deny *the fact*, that, under certain peculiar conditions, the mind of one person can so react upon and influence the mind of another, as to make the latter, so to speak, reflect its own thoughts and feelings, and cause the individual to give expression to these thoughts and feelings in words. There are unquestionably evidences of this fact; the difficulty is how to explain it satisfactorily. But this circumstance does not, surely, constitute a sufficient reason for philosophers either to ignore or ridicule it. It is to be wished that some master-mind, uninfluenced by conceit or prejudice, would grapple with this knotty subject in psychology, and give to the scientific world the result of its investigation.

We pass by the different Special Senses, all of which are treated of with the author's usual care and discrimination, but which our space will not permit us to dwell upon; merely observing that the article on Vision is very full, in fact, exhaustive on the subject.

The Vegetative Functions next claim attention. These are classified under the heads of Digestion, Absorption, Circulation, Nutrition, Sanguification, Secretion, Respiration, and Animal Heat, Light, and Electricity. These all present a tempting field for passing remark, but we can only notice one or two of them very cursorily.

The description of the various organs of digestion, together with their separate functions, is graphic and clear, being appropriately illustrated with wood-cuts. As regards the composition of the gastric juice, one would suppose that if any point in physiology could be definitely settled, this ought to be the one; but it is not so. A note by the American editor gives us the result of some of his own and Prof. Rogers' experiments, made in the year 1856, upon the gastric secretion of the Canadian, St. Martin, chiefly with the view to determine the true nature of its *acid.* The results obtained were: "that the acid reaction was not due to phosphoric acid; that if hydrochloric acid were present, it was only in very small quantities; that the main agent in producing the characteristic reaction was *lactic acid.*" (p. 530.) This was also, if we mistake not, the opinion of M. Bernard.

The description of the secretion and uses of the other different digestive fluids—saliva, pancreatic fluid, bile, and intestinal juices—is admirably given; it closes with a brief account of the Relative Value of Different Foods, and a most interesting statement of the Organs and Functions of Digestion in Animals.

Absorption is very well described, being divided into General Absorption, Absorption of the Food, and Intrinsic Absorption. The process is essentially a purely physical act—a true osmosis, as is clearly demonstrated by the author, as also by the editor, who appends an interesting note upon the subject.

Under the head of Circulation, we notice a clear and accurate account of the Action and Sounds of the Heart; together with a concise description of the *Sphygmograph,* and its practical uses and application in estimating the pulse. As regards the Capillary Circulation, the author is of the opinion that the efficient cause is the ventricular contraction of the heart, modified by the elasticity of the arteries (p. 674):—

> "The real propulsive *cause* of the motion of the blood in the capillaries is the same as that of the arterial circulation, viz., the ventricular systole, modified in its effects by the resilience of the elastic coat of the arteries themselves."

But, that this cannot be the sole cause of the vascular movement in the capillaries, is shown by the one conclusive fact (not to cite several others) that a capillary circulation exists in the embryo condition of animals, before the development of the heart; and that the direction of the current is *towards*, and not from the centre of circulation; and also that it is found in some of the lower animals, that are entirely destitute of a heart. In truth, the cause of the capillary movement seems to be of a complex nature. Undoubtedly, in the higher animals, both the heart and arteries do contribute materially to the result; but it has always seemed to us impossible entirely to ignore a certain action going on in the capillaries themselves, wholly independent of the *vis à tergo* of the heart and arteries. When we remember that it is in the capillary region that all the great functions of organic life are performed, it seems but natural to suppose that here would be manifested a force or power, which might be supplemental at least, if not the efficient cause of the movement in question. With our knowledge, at present so much extended, of the dynamics of the body, it appears to us that the author does not give due credit to the well-known physical law governing ordinary capillary attraction, viz., that the rise of fluids in capillary tubes is not only dependent upon the calibre of the tube, but upon the affinity between the sides of the tube and the contained fluid. Why should not this constitute a moving force in the capillary rete, both of animals and vegetables? It is just here, as has been observed, that all the great *functionating* (if we may use the expression) acts of the system are produced. The blood is here incessantly changing its condition, by losing and acquiring certain constituents; consequently, its relative relation to these tubes must be as constantly undergoing change; and by analogy of reasoning there ought to follow not only a movement but a constant change both in the rate and direction of this movement—just precisely what we do observe in a microscopic examination of the circulation in the thin tissue of a frog's foot, or still better, in a partially incubated egg.

As has been explained by Prof. Draper, if two liquids be made to communicate with each other through a capillary tube, or through a network of tubes, for which they have an unequal affinity, a movement will ensue; the one liquid will be displaced by the other, for which the tube has a greater attraction. Now to apply this to the circulation of the sap in vegetables, and of the blood in the capillaries: the different ultimate cells of the structure have a different affinity for different materials of the circulating fluid; such materials are appropriated to these individual parts, and the circulating fluid having given up these materials has no longer the same attraction for those particular capillary tubes that it had before; it is consequently driven from them by the superior attraction which is now exerted by a new portion of the fluid, which is destined, in like manner, to be replaced by another portion, and so on. Take the capillary circulation of the lungs for an illustration: Venous blood has just been propelled into these organs through the pulmonary artery; in the capillary rete the interchange takes place between the oxygen of the inspired air and the carbonic acid of the blood; but when the blood has become thus arterialized, it no longer has the same affinity for the capillary tubes that it had before; hence it must be driven onwards by the venous blood behind it. Precisely the opposite affinities will operate in the capillaries of the other parts of the body; for here the attraction being between arterialized blood and the tissues, the venous blood will be displaced, and driven out on the other side, by the arterial blood.

Certain pathological conditions would also seem to give support to this theory. In asphyxia there is an accumulation of venous blood in the lungs—a stasis, in fact, resulting simply from the deficiency of oxygen.

The interchange between this gas and carbonic acid not taking place, the change of affinity cannot occur between the vessels and the contained fluid; and there is nothing to push it forward through the pulmonary veins into the left side of the heart, even although this organ is doing its utmost to overcome the difficulty. Again, it is well known that the activity of the capillary circulation of any part of the body is dependent upon the *activity of the functional changes* going on in it, whilst the general circulation remains unaltered. The condition known as *active congestion*, or *determination of blood* is unquestionably dependent upon an undue functional activity of the part. This is well illustrated in the development of the testes at puberty, and of the mammary gland during lactation. The old aphorism " ubi stimulus ibi fluxus" is based upon these well-established facts.

It is true that our author alludes very briefly to the above theory, though he evidently attaches very little importance to it, dismissing it with the observation, that such an action of these vessels implies only "an exercise of elasticity in their walls: but this cannot be under any circumstances, a moving force in the circulation, but rather a means of adapting the size of the capillaries to the variations in their contents." (p. 675.)

Two other subsidiary or modifying influences over the capillary circulation are also overlooked: the one is a tendency to a partial vacuum in the vessels owing to the constant osmose through their walls, which would naturally exert a *vis à fronte* movement; the other is the influence exerted by the nervous system, which, though not essential, is very manifest. Familiar instances are exhibited in the phenomena of blushing and pallor, under emotion; also in the salivary and lachrymal secretions, under similar influences; and through the same agency, doubtless, the peculiar sensation experienced by nursing women, termed "the draught," which is often excited by the sight and even by the thought of the child.

The subject of Nutrition is well discussed, due attention being also given to its different pathological states, the uses of the several constituents of the blood in nutrition, together with some practical remarks on Hemorrhage and Transfusion next follow; after which the subject of the Coagulation of the Blood receives a full attention. Here, the editor appends a short note, giving Dr. Richardson's latest views on this phenomenon, as referred to in this Journal. [See No. for January, 1868, page 245.]

Under the head of Sanguification, we have a very interesting description of the structure and probable function of certain curious bodies, called by the author *ductless glands*, such as the Spleen, Supra-renal Capsules, Thyroid and Thymus Bodies, all of which are now generally believed to contribute essentially to proper sanguification, or to act, in the author's language, as *blood-glands*. In connection with this subject, we have also an admirable dissertation on the " Glycogenic Function of the Liver," considered as distinct from its office of secreting bile.

The subject of Secretion receives a due degree of attention; the true difference being pointed out between the secretions proper, in which new products are manufactured, so to speak, by the secerning gland-cells, and the *excretions*, which are reduced oxidized products, resulting from decomposition.

Of the different special secretions and excretions it is unnecessary to speak further than to say that the author has given a sufficiently full account of each one, dwelling especially, as was fitting, upon the urine.

The function of Respiration is very fully discussed in all its different aspects, physical, chemical and dynamical. With regard to the change of color of the blood, produced by respiration, the heretofore received theory has been that it is dependent on optical causes; being due to a modification of the refractive power of the corpuscles. In the shrunken or biconcave state, "their refractive power is increased, and a larger amount of reflection takes place from the surfaces of contact of the corpuscles with the surrounding fluid. Whilst in the distended state, their refractive power is diminished, and less reflection takes place." Although it is true that venous blood is brightened by contact with saline solutions, and arterial blood is darkened by contact with water, it by no means necessarily follows that this is the true explanation of the natural alterations of color produced by the respiratory process. Moreover, as the author justly observes, there is no positive proof that venous blood contains fewer salts than arterial blood. Besides, experiments go to show that when pure solutions of the coloring matter of blood are alternately agitated with oxygen gas and carbonic acid, similar changes in their colour result; in the former case, the hue being brightened, and in the latter, rendered dark.

The beautiful experiments by means of the spectrum analysis, which had already given such wonderfully delicate results in inorganic chemistry, have led to the tolerably settled opinion, first suggested by Prof. Stokes, that "the natural colouring matter of the blood (cruorin) is capable, like the colouring matter of indigo, of assuming, by alternate abstraction and reintroduction of oxygen, two states of oxidation, in which it differs in colour and in its action on the spectrum."

This *cruorin* is not identical with what is usually regarded as *hæmatin;* the latter being considered as an artificial compound, produced from the former by acids. The cruorin has a powerful attraction for oxygen, from which circumstance is supposed to result the special affinity of the red corpuscles for this gas. It seems further settled by these researches "that the oxygen which is carried through the body by the blood, is, to a large extent, actually chemically combined with it, *i. e.*, with the cruorin of the red corpuscles." (p. 832.) There is still, however, a certain amount of oxygen retained in solution by the liquor sanguinis.

Connected with the subject of respiration, we have some good practical observations on asphyxia, suspended animation, and the effects of breathing impure air. The appended remarks on the Respiration of Birds and Aquatic Animals are most interesting and appropriate.

Animal Heat, Light, and Electricity form the next subject of notice. Our author agrees with most modern physiologists in ascribing animal temperature to a true oxidation; the incidental influence of the nervous system is, however, duly recognized. Under this head, the subject of Spontaneous Combustion receives a very brief notice, sufficient, however, to show that the whole matter is to be regarded as apocryphal, no case of actual spontaneous burning of a living human body having been established by eyewitnesses. As the subject has, at times, become a matter of consideration in legal medicine, it may be proper here to cite the authority of Professor Casper, of Berlin,[1] as being entirely opposed to the idea.

Under the heading of the Statics and Dynamics of the Human Body, certain interesting and important questions are disposed of, such as the height and weight of the body; quantity and quality of food and its relation to the constituents of the body; destination of the food in the living economy; the organic and inorganic forces at work in the body; the calorific and mechanical work of the body, and their relation to the food. Upon each of these questions the author shows his familiarity with all the latest experiments and deductions, which it is not necessary here to individualize.

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[1] Handbook of Forensic Medicine, by Johann Ludwig Casper, M. D., &c. New Sydenham Society's Edition, vol. i. p. 304.

The important function of Reproduction receives a thorough attention from the author. Rejecting, both as unphilosophic and unproven, the theories of spontaneous generation, he gives a brief summary of the experiments of Pasteur. The various modes of reproduction are then discussed sufficiently at large. The changes in the ovum, before and after fertilization, are well described and illustrated; together with the account of the development of the several tissues and organs of the body; the whole being concluded with a brief dissertation on Decay and Death.

From what has been said, the reader will readily gather that the work of Mr. Marshall is regarded by us in a very favourable light. As already intimated, it quite fulfils, in our opinion, the author's design of making it truly *educational* in its character—which is, perhaps, the highest commendation that can be asked. The additions of the American editor are necessarily few, but always judicious; and we may congratulate him on having selected so excellent a text-book for the University classes.

J. J. R.

ART. XXI.—*Discussion sur la Folie raisonnante. Société Médico-Psychologique.* Annales Médico-Psychologiques. Paris, Numeros pour 1866 et 1867.

Discussion on Moral Insanity in the Medico-Psychological Society. Paris, 1866 and 1867.

NOTHING in the medical history of mental diseases has excited more interest, of late years, than what is called Moral Insanity. And yet it would be difficult to find any subject of equal interest and importance in regard to which there is so much misconception of the essential points at issue, and so much misapprehension of the actual facts concerned. To this state of opinion there is also joined a kind of feeling growing out of the practical consequences of the doctrine more likely to foster prejudice than to promote the success of a scientific inquiry. The stoutest believer in moral insanity will not deny that his faith is shared by comparatively few, not only among men of general culture, but also among those whose kindred pursuits might seem likely to lead them to the same conclusions. We know that the mention of moral insanity in a court of justice is enough to excite a smile of derision, as if it were only an artful dodge got up for the purpose of screening a criminal offender, or, in some way, of preventing the due course of justice. That the same feeling pervades the medical profession, and not seldom appears among those who are particularly conversant with the insane, there is abundant reason to believe. It matters not that this form of disease is recognized by the most accredited writers on insanity, and that cases may be witnessed in abundance in every hospital in the land. It is, nevertheless, regarded as a crotchet of a few impulsive men who have mistaken a creation of fancy for the result of a true scientific